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sometimes, at any rate, the ascidiozoöids of these fully compound colonies are noticeably smaller than those of the social forms.

The specimens studied by Caullery were collected by Lesson in 1825, locality not given; and by Quoy et Gaimard in 1829 on the coast of Australia.

WM. E. RITTER.

Parthenogenesis of the Honeybee. — Weismann[1] publishes an interesting preliminary account of studies on the parthenogenesis of bees, which have been carried on in his laboratory for the past three years. The conclusions of Dzierzon, confirmed by von Siebold and Leuckart, that fertilized eggs always produce workers (or queens), and unfertilized, drones (or males), having been in recent years called in question by practical bee culturists, Weismann deemed it imperative to have the question reinvestigated, especially in view of its great theoretical importance. He accordingly induced one of his students, Dr. Paulcke, to undertake the problem, and the studies thus begun are now being completed by Dr. Petrunkewitsch, another of Weismann's students.

One of the most energetic of the recent opponents of Dzierzon's conclusions has been the editor of the *Nördlinger Bienenzeitung*, F. Dickel of Darmstadt. His experiments seemed to prove that normally *all* eggs are fertilized. Eggs which had been laid in drone cells were transferred to worker cells, with the result that they developed into workers, and *vice versa*. Dickel argued, further, that the evidence of von Siebold and Leuckart, based on the microscopic examination of the eggs, could not be regarded as definitive, now that we know more precisely the phenomena accompanying fertilization. These observers had not examined eggs immediately after they were laid, but only after the lapse of from one to twelve hours. But it is now known that spermatozoa lose their thread-like form within a few hours after the eggs are laid, and are succeeded by the sperm nucleus and sperm aster; in fact, it has been recently asserted that this metamorphosis takes place in bees' eggs within fifteen or twenty minutes after the entrance of the spermatozoön into the egg.

Nevertheless, there is no ground to doubt, says Weismann, that von Siebold saw seminal filaments (even two to four in a single egg), for Blochmann, making use of the sectioning method, has seen the same, and Petrunkewitsch now confirms the observation; but these could have been seen only in von Siebold's freshest eggs, all of which were, however, from *worker cells*. The twenty-seven drone eggs which he examined were all "about twelve hours old," so that his failure to find in them sperm filaments is in no way proof that fertilization had not taken place.

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[1] Weismann, A. Ueber die Parthenogenese der Bienen, *Anat. Anzeiger*, Bd. xviii, Heft 20–21, pp. 492–499, December 5, 1900.

The most of the material for the investigations in Weismann's laboratory was furnished by F. Dickel, who took the eggs from the hives, put them at once into the preservative fluid and sent them to Weismann. The main results are as follows: Whether the egg is fertilized or not can be determined with certainty only when it is killed in the stage of the *second* maturation spindle. Before that, in the stage of the *first* maturation spindle, either the sperm nucleus is without radiations, or the sperm filament has not yet been metamorphosed into a sperm nucleus. In either case it is a matter of chance, depending on location and physical condition whether the sperm cell can be recognized with certainty. In the second-spindle stage, on the contrary, the formation of a sperm aster is completed and the structure can neither be overlooked nor misinterpreted. Petrunkewitsch sectioned 123 eggs that were in the first-spindle stage. Twenty-nine of these were from *worker* cells; in twenty-three cases (79%) the sperm nucleus with radiations was present. On the other hand, *not a single* sperm aster was found in any of the ninety-four eggs from *drone* cells. The condition of eggs in the second-spindle stage was still more striking. *Every one* of the sixty-two eggs from *worker* cells showed the sperm aster; whereas of the 272 eggs from drone cells *only one* contained a sperm aster. It is explained by Weismann that in this one case the queen probably made a mistake and deposited a fertilized egg in the wrong (drone) cell, a phenomenon which bee-keepers have long recognized as occasionally taking place.

Weismann believes, therefore, that Dzierzon's views are fully confirmed, — that normally eggs laid in drone cells are *not fertilized* and that those laid in worker cells are always *fertilized*.

Dickel's observation, that as soon as the queen has laid an egg, workers enter the cell and busy themselves with the egg, probably licking it and coating it with saliva, does not warrant his conclusion that the sex is determined thereby. What the significance of that act may be is not known. That it is of importance seems to follow from the results of some of Dickel's experiments. He isolated a comb containing freshly deposited eggs by removing the workers from it and then enclosing it in fine gauze, without, however, removing the comb from the hive. All such eggs perished sooner or later, frequently in late embryonic stages. It may be that here, and in other insects whose eggs have a thin chorion, there is need that the egg be coated with saliva to prevent its drying up. Whatever the influence of the secretions of the three pairs of salivary glands, sex in bees is determined by the existence or absence of fertilization. Other conditions within the sex — whether, for example, worker or queen shall result — may be determined (as they apparently also are in termites, according to Grassi's observations) by the quantity and quality of the food, including the salivary secretions. *How* it is that fertilization determines sex is not known, but that it does can no longer be denied.

Dickel has insisted that there is a difference between drones produced by fertile workers and those produced by queens, and he believes that the former are infertile. Weismann says he knows of no proof of this, but admits that the studies of Petrunkewitsch show that there is a slight, though constant, difference in the early phenomena of development between unfertilized eggs from queens and those from workers, and that this may possibly be of importance. Further study on this point is required. A difference between queen-drones and worker-drones is *a priori* in no way improbable; indeed, there is a wasp in which two kinds of drones are known to exist, though it is not known whether these have the same or a different parentage.

m.

Artificial Parthenogenesis. — Following the lead of Morgan and Loeb, who have shown that certain salts can induce the development more or less complete of unfertilized eggs of the sea-urchin, Pieri[1] and Winkler[2] have, independently of each other, tried to induce development of the unfertilized echinoderm egg by means of sperm extract. Their efforts have been at least partially successful, though the observations made are less extensive than might be desired.

Pieri took fresh, sound sperm of *Strongylocentrotus lividus*, or of *Echinus esculentus*, and shook up the same either in sea water or in distilled water. The fluid was then filtered and examined under the microscope. It was found to contain still a certain number of spermatozoa, but these were motionless, rounded, tailless, and, so far as direct observation could show, dead. Unfertilized eggs of the species from which the sperm was obtained were then placed in some of this

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[1] Pieri, J. B. (**'99**). *Exp.* (3), 7, Notes et revues, *Arch. de Zool.*, p. xxix.

[2] Winkler, H. (**1900**). *Nachrichten v. d. k. Gesellsch. d. Wiss.* Göttingen, *Math.-phys. Klasse*, p. 187.